

# GEOSEDIMENTOLOGY

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**Project title: The Structure, Facies, and Deposition of Siliceous Sinter Around Thermal Springs:  
Implications for the Recognition and Study of Early Life on Earth and Mars**

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**Objectives:** 1) To study the texture and structuring of siliceous sinter deposited around hot springs and geysers and to determine the physical, chemical, and biological controls on its deposition. 2) To identify and characterize the role of thermophilic organisms on sinter deposition. 3) To compare the structuring of siliceous sinter around Yellowstone hot springs and geysers with that of siliceous rocks 3.5–3.0 billion years old to determine if any of these ancient rocks represent ancient hot spring deposits and if there is any record of biological influences on their deposition. 4) To evaluate whether there are features of sinter that are diagnostic of biological influences that could aid in the possible identification of organisms in hot spring deposits on other planets, especially Mars.

**Findings:** Our investigations to date have emphasized the hydrodynamic controls on the structuring and morphology of siliceous sinter around alkaline hot springs and geysers in YNP. This research has been divided into two parts: 1) an investigation of low-temperature (less than 73°C) sinter facies, where microbial mats play a major role in the structuring and deposition of sinter at all observational levels; and 2) an investigation of high-temperature (greater than 73°C) sinter facies where thermophilic microbes are less obvious as mats but biofilms may play a role in mediating silica precipitation rates and influencing structuring and textures of sinter. Our results to date indicate that, within the high temperature zone, microbes may play a role in silica microstructure, but that hydronamics and evaporation control where silica is deposited and the larger-scale morphology and structuring of the deposits.

During 2002, additional fieldwork is planned for late May and June, mainly with the objective of monitoring silica deposition rates in a number of hot springs.

**Project title: Educational Field Trip to Examine Hot Springs, Sinter, and Bacterial Mats,**

### **Yellowstone National Park**

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**Objective:** The object of this activity was to bring a group of six undergraduate and three graduate students from Stanford University to Yellowstone National Park to introduce them to research and study of bacterial mats and siliceous sinter deposits in the runout systems of hot springs and geysers.

**Findings:** The group visited Yellowstone from June 14 to June 19, 2001. The undergraduates undertook one-day projects, in which they mapped Octopus Spring or a spring in the 5-Sisters group, measured temperature profiles down the runout system, plotted bacterial mat types, and mapped the distribution of siliceous sinter. These projects were completed on June 15, 2001. Short reports were prepared in the evenings during their stay and handed in before we returned to Stanford. On June 16 we visited Steep Cone Spring and Sentinel Meadow to examine sinter mounds, on June 17 we hiked into Shoshone geyser basin to study Coral Pool and surrounding thermal features, and on June 18 we visited Fountain Paint Pots to examine in-place sinter growth experiments.